FORWARD

The Final MATES-II report addresses comments received since the release of the draft document. Changes to text are given with underline and strikeout for ease of noting the changes made. Also, the following tables and figures have been revised:

TABLES	FIGURES
1-1 (new)	ES-2
4-1	ES-5
4-2	4-1
4-3 (new)	4-2
5-1	4-6
5-2	5-2d
5-3	5-2e
6-5	5-3a
9-1 (new)	5-3b
9-2 (new)	

Finally, Chapter 9 has been added to the report to provide a summary of the comments received and the AQMD staff's responses to those comments.

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Executive Summary

The Multiple Air Toxics Exposure Study (MATES-II) is a landmark urban toxics monitoring and evaluation study conducted for the South Coast Air Basin (Basin). The study was initiated as part of the Environmental Justice Initiatives adopted by the South Coast Air Quality Management District (District) Governing Board in October 1997. The study represents one of the most comprehensive air toxics programs ever conducted in an urban environment, and certainly much more comprehensive than a similar study (MATES-I) conducted by the District over a decade ago.

The MATES-II project consists of several elements. It consists of a comprehensive monitoring program, an updated emissions inventory of toxic air contaminants, and a modeling effort to fully characterize Basin risk.

There were two separate monitoring components to MATES-II: (1) a network of 10 fixed sites which monitored for toxic air contaminants once every six days for an entire year (from April 1998 through March 1999); and (2) a microscale study which utilized three mobile platforms to sample at 14 additional communities. The microscale study specifically targeted residential areas which could be influenced by nearby sources of toxic emissions. In order to cover all these locations in a one-year period, the sampling platforms were situated in a community for a one-month period. For the entire program, both fixed and microscale sites, over 4,500 samples were collected and analyzed. Due to the large number of samples, laboratories at both the District and the California Air Resources Board (ARB) shared responsibilities for the chemical analyses.

In addition to the monitoring portion, MATES-II also included an update of the latest toxics emissions inventories for the Basin, and computer modeling to determine a more complete picture of toxics risks. Since it is not feasible to conduct sampling at each and every location in the Basin, it is important to utilize the models to provide predictions for locations where monitoring has not been possible. (It should be noted that the costs for this program are over $750,000, not counting the in-kind services provided by the ARB.)

To provide important scientific guidance to the District during the study, the Air Toxics Study Technical Review Group (ATSTRG) was formed. This panel of 13 experts from academia, environmental groups, industry, and public agencies, representing expertise in air toxics, was assembled to review the project from inception, and to offer guidance on ways to improve the study. The program design reflected, to a large extent, the input provided by this panel.

In the monitoring program, over 30 air pollutants were measured. (Table ES-1). These included both gas and particulates. Toxic air contaminants are determined by the U.S. EPA, and by the California EPA, including the Office of Environmental Health Hazard Assessment and the ARB. For purposes of this study, the California toxic risk factors are used.

Table ES-1

Pollutants Measured in MATES-II

CAS No.	Chemical Name	CAS No.	Chemical Name
71432	Benzene	50000	Formaldehyde
7440439	1,3 Butadiene	75070	Acetaldehyde
106467	Dichlorobenzene (ortho- & para)		Acetone
75014	Vinyl Chloride	7440382	Arsenic
10414	Ethyl Benzene		Chromium
	Toluene	7439921	Lead
	Xylene (m-, p-, o-)	7440020	Nickel
	Styrene		Cobalt
56235	Carbon Tetrachloride		Copper
67663	Chloroform		Manganese
75343	Dichloroethane [1,1]	7723140	Phosphorous
	Dichloroethylene [1,1]		Selenium
75092	Methylene Chloride		Silica
127184	Perchloroethylene		Silver
79016	Trichloroethylene		Zinc
74783	Chloromethane		PAHs
			Elemental Carbon
			Organic Carbon

Toxic measurements in the Basin are not new. Although MATES-II represents the most comprehensive study of its kind, the ARB has collected samples at five sites in the Basin since 1990. As a background to the current study, an evaluation of the trends of key toxic pollutants was conducted. Data from all sites have shown a pronounced decrease in toxic levels in the Basin from 1990 through 1997. In fact, the risk associated with cancer rates (often referred to as "carcinogenic risk") associated with air toxics has decreased by about 50 percent during this period.

When “carcinogenic risk” is discussed, it typically refers to the increased probability ~~of a person contracting cancer over the course of a lifetime if exposed to the source of cancer-causing compounds for~~ that an individual exposed to an average air concentration of a chemical will develop cancer when exposed over 70 years. Cancer risks are often expressed on a per-million basis for comparative purposes. ~~In other words~~ As an example, a cancer risk of 100 in a million at a location means that the individuals staying at that location for 70 years have a 100 in a million chance of contracting cancer.

A “cancer burden” typically refers to the number of excess cancer cases expected in the exposed population. If 10,000 people live at that location, then the cancer burden for this population will be one (the population multiplied by the cancer risk). This means that one of the 10,000 people staying at the location for 70 years is~~are~~ ~~expected~~ estimated to contract cancer.

To make carcinogenic risk determinations, at least one full year of data is strongly recommended to represent exposure potential. This is why the fixed site network (or “regional study”) was conducted over a one-year period. The microscale study, on the other hand, is intended more to determine ~~potential localized~~ ~~“hot spots.”~~ whether

localized sources of emissions cause a significant increase in concentration of certain toxic air contaminants. ~~causing a measurable localized increase in risk due to toxic an contaminant emissions.~~ Data collected at these sites cannot readily be expressed in terms of risk because only one month of data is available at 12 of the 14 microscale sites. (At two sites, sampling was conducted for one month during each calendar quarter.) Localized conditions can be assessed, however, by comparing the toxic levels at each microscale site to its nearest station in the fixed-site network. Where differences occur the microscale influences of nearby sources can be estimated. To further complement this assessment, microscale-level modeling has been included in this study, as well as an enhanced toxics inventory in the immediate vicinity of each microscale site. These efforts, combined, provide a mechanism for both regional-scale and local-scale air toxic characterizations across the Basin.

Consistent with the fact that most of the region's population and toxic-emitting sources are within Los Angeles County, most of the monitoring sites were placed in Los Angeles County. Of the 10 fixed sites, seven were in Los Angeles County, and one each in the other three counties of the Basin. Because fixed sites are situated based on EPA guidelines for "neighborhood scale" monitoring, each of the ten locations may be representative of adjacent communities as well. Microscale sites, on the other hand, were specifically located to characterize ~~for~~ localized conditions. For the 14 microscale sites, eight were in Los Angeles County and two in each of the other three counties. (See Figure ES-1.) Unlike reactive pollutants, such as ozone and fine particulates which increase in concentration as the wind carries its precursor emissions inland, many toxic pollutants are non-reactive. This means that highest levels are expected to be close to the sources.

The key results of the MATES-II study are as follows;

Fixed-Site (Regional) Program

A. Monitoring

1) The ~~average~~ carcinogenic risk in the Basin is about 1,400 per million people[*]. Mobile sources (e.g., cars, trucks, trains, ships, aircraft, etc.) represent the greatest contributor. About 70% of all risk is attributed to diesel particulate emissions; about 20% to other toxics associated with mobile sources (including benzene, butadiene, and formaldehyde); about 10% of all risk is attributed to stationary sources (which include industries and other certain businesses such as dry cleaners and chrome plating operations.) (See Figure ES-2.)

2) The carcinogenic risk of 1,400 per million is based on a range from about 1,120 in a million to about 1,740 in a million among the ten sites. (See Figure ES-3, top.)

[*] Based on the average of the pollutant concentrations measured at the fixed monitoring sites.

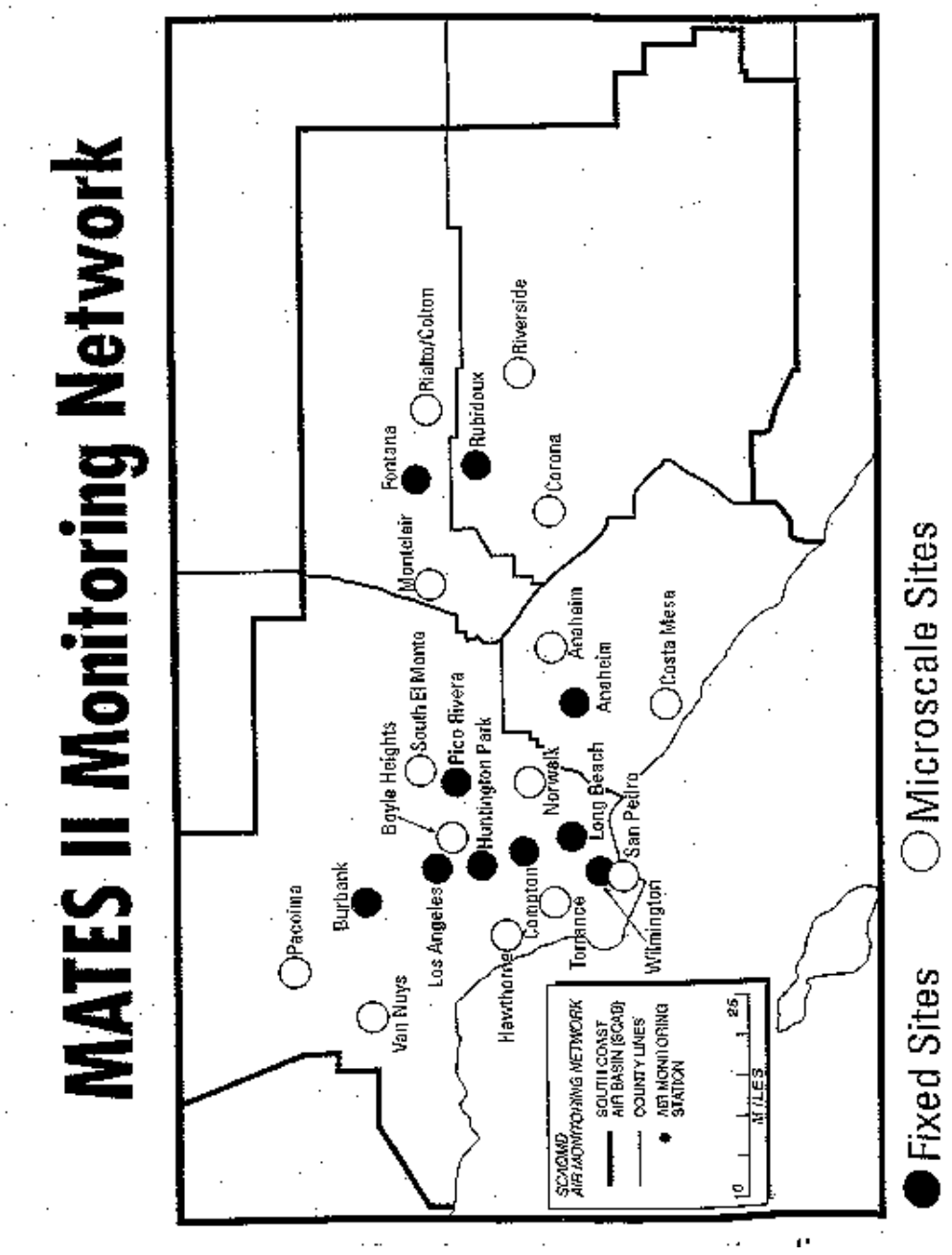


Figure ES-1. Map of MATES - II Monitoring Locations

3) The sites with the greatest risk levels were in the south-central and east-central portions of Los Angeles County. At these locations, the dominance of mobile sources is even greater than at other sites. The sites with the lower risk levels were mostly in the other three counties. (See Figure ES-3, top and middle.)

4) The differences in carcinogenic risk from one site to another are much more driven by the influence from mobile sources than from stationary sources. (See Figure ES-3, top and middle.)

5) The carcinogenic risk from one site to another, as ascribed to stationary sources, is rather uniform across the Basin. In this respect, there is not much difference among the four county sites. (See Figure ES-3, bottom.)

6) There are strong seasonal variations to the levels of toxic air contaminants, primarily with those pollutants associated with mobile sources. Elemental carbon (a surrogate for diesel particulates), benzene, and butadiene – all have seasonal peaks in the late fall and winter months. Lowest levels are observed during the spring and summer months. (See Figure ES-4, top.)

7) The seasonal variations with respect to toxic air contaminants from stationary sources are generally small. Levels are quite consistent across all months of the year. (See Figure ES-4, bottom.)

8) Levels of risk are, for the most part, consistent with the long-term downward trends evident in the ARB data since 1990. Noticeable improvements have occurred for three major elements of toxic risk: hexavalent chromium, benzene, and butadiene. (Note: trends for diesel particulates are not available from the ARB data, however, elemental carbon trends recently reported by Christoforou, et al., (2000) indicate a decrease of about 32% from the early 1980's to the early 1990's.)

B. Modeling

1) Model results show similar ~~average~~ levels of carcinogenic risk across the Basin as does the monitoring data. Models also show the strong domination of mobile sources contributing to risk.

2) The model results, which are more complete in describing risk levels across the Basin than is possible with the monitored data, show that the higher~~est~~ risk levels occur in the south-central Los Angeles area, in the harbor area, and near freeways. (See Figure ES-5.)

3) Results suggest that the ~~average basin~~ basinwide cancer risk level may be 16~~7~~ percent lower than the ~~average~~ corresponding risk levels estimated from the monitoring sites.

4) Results show that the higher pollutant concentrations generally occur near their emission sources.

5) Models generally underestimate measured values. It is estimated that model performance would improve with the latest versions of the mobile source emission models provided by the California Air Resources Board.

Microscale Program

1) With few exceptions, the monitoring at each of the 14 microscale sites did not register ~~abnormally~~ significantly higher levels of any toxic air contaminants. However, it cannot be concluded that “hot spots” do not exist at other locations.

2) ~~An abnormally~~ Significantly higher levels of styrene (not~~not considered to be~~ currently assigned a carcinogenic risk factor, but ~~one~~ a pollutant which was measured as part of the laboratory analysis) was observed at the Anaheim microscale site. This finding is corroborated by an examination of local emissions inventories which found three facilities that emit styrene to be close to the monitoring site. This illustrates that local "hot spots" do occur.

3) ~~Abnormally~~ Significantly higher levels of formaldehyde were measured at the San Pedro microscale site. The nature of the measurements, showing decreasing levels of formaldehyde over time, and insensitivity of such levels to changes in wind directions, suggest an instrument contamination problem as the cause for this observation.

4) Even at microscale sites, the risk impacts are dominated more by mobile sources than by stationary sources. For only two sites (Torrance and Costa Mesa) are stationary sources more dominant than mobile sources. At these sites, they do not necessarily have higher stationary source emissions, rather there is a noticeable decrease in the levels of toxic air contaminants from mobile sources.

5) Levels of toxic air contaminants associated with stationary source emissions are reasonably uniform among the microscale sites, consistent with the findings from the fixed site locations.

6) Facility-based modeling conducted as part of the permitting process shows that highest levels of toxic air contaminants can occur very close to the fence-line of facilities. Due to logistical constraints in placing mobile monitoring platforms, ~~L~~locations other than where the microscale platforms were located could therefore have higher levels than at the microscale monitoring sites.

Caveats and Risk Uncertainty

1) There is currently no technique to directly measure diesel particulates, the major contributor to basinwide carcinogenic risk. Based on research results as reported by ARB, diesel particulates can be estimated by measuring elemental carbon, a black, sooty particulate. In essence, elemental carbon becomes a surrogate for diesel particulates. Although this estimating technique is likely to have uncertainties, the emissions inventory and modeling, which account for directly emitted diesel particulates, confirm that diesel particulates are the major contributor to carcinogenic risk.

2) The determination of risk values for each compound carries a level of uncertainty, which, for some pollutants, is large.~~.~~ Typically, the risk values are derived from animal or epidemiological studies of exposed workers or other populations. Uncertainty occurs from the application of individual results to the general population. When risk factors for specific compounds are determined, levels are usually established conservatively. There is considerable debate on appropriate risk values, and often the levels established by the USEPA and CalEPA differ. For the purpose of this study, California values are used.

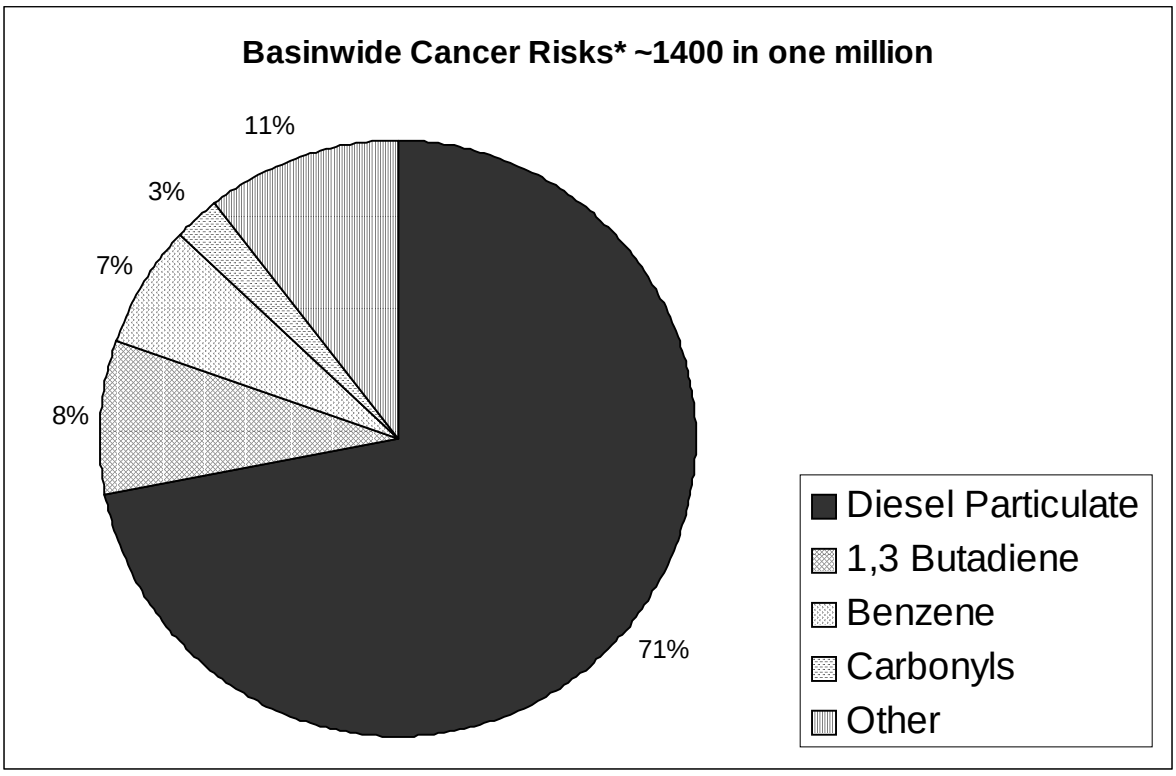
3) There is further debate as to the appropriate levels of risk ascribed to diesel particulates. CalEPA, in recommending a cancer risk level of 300 in a million per microgram per cubic meter (ug/m^3) of diesel particulates, considered evidence which suggested diesel risks as low as 150 in a million to as high as ~~1,500~~ 2,400 in a million per ug/m^3. The USEPA has not yet declared diesel particulates as a toxic air contaminant. Thus, the selection of a risk factor for diesel particulates can have a substantial effect in assessing overall risks; however, ~~it~~even using the lowest bound of the CalEPA-recommended risk factor (150 in a million) does not change diesel's domination in the overall risks. For purposes of this study, and to be consistent with the approaches used for other toxic pollutants, the CalEPA recommended value of 300 in a million per ug/m^3 is used.

4) There is an estimated uncertainty level of ± 25 percent associated with laboratory measurements of many toxic compounds. Part of this uncertainty is attributed to the fact that many of the toxic compounds measured are at extremely low concentration levels, at parts per billion (ppb) levels, and often near the detection limits of the instrumentation. A number of compounds cannot be detected at all. When non-detections occur, it is assumed that the actual levels are not zero, but are half of the instrument detection limit. In other words, if the detection limit is 1 ppb, and a compound is not detected at that level, it is assumed that the actual concentration is one-half of 1 ppb. This convention has been in use by the Air Resources Board since the reporting of monitored toxics in the state commenced in 1990. This convention allows the vast majority of the data users to statistically manage the data. Other methods of handling non-detects are often difficult to implement or offer no practical advantage. The method is a conservative one that protects the public when analytical shortcomings cannot address real emissions that are known to exist. Although this convention is not in regulation form~~a codified policy~~, it is considered at this time to be the best available tool for

addressing concentrations of pollutants where current laboratory technologies cannot yet detect such low levels, and at the same time treating public safety concerns. As a sensitivity test, it was assumed that non-detect values were zero for those pollutants which had a predominance of non-detections. Under such an assumption, the overall risk values would have been lowered by 4.6%.

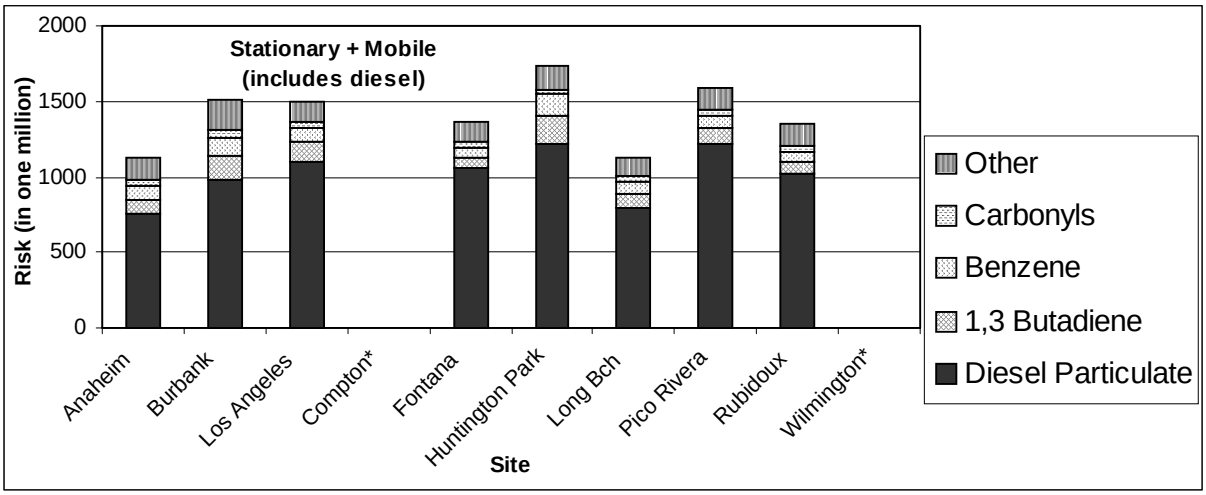
Figure ES-2

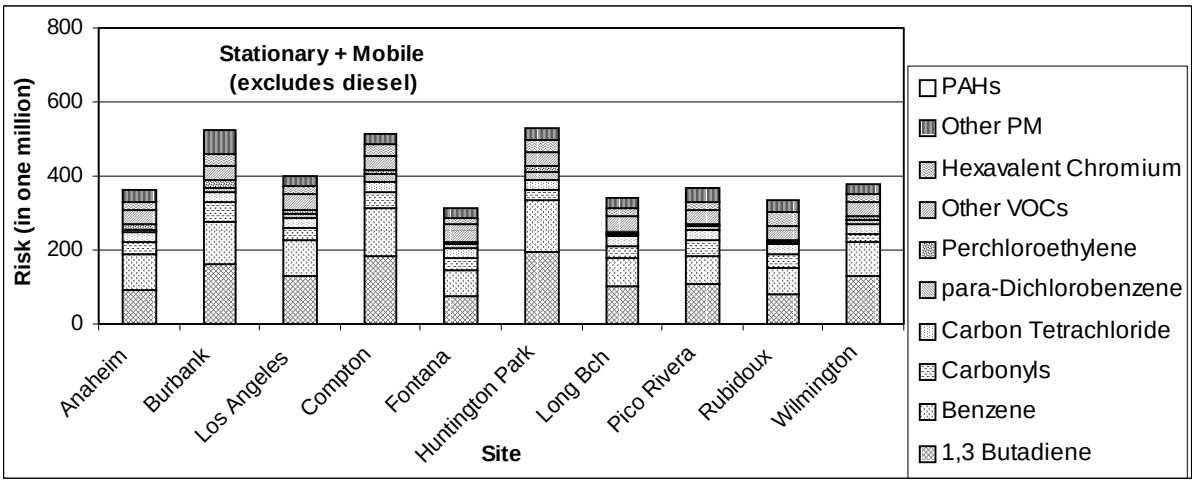
Major Pollutants Contributing to Cancer Risk
In the South Coast Air Basin

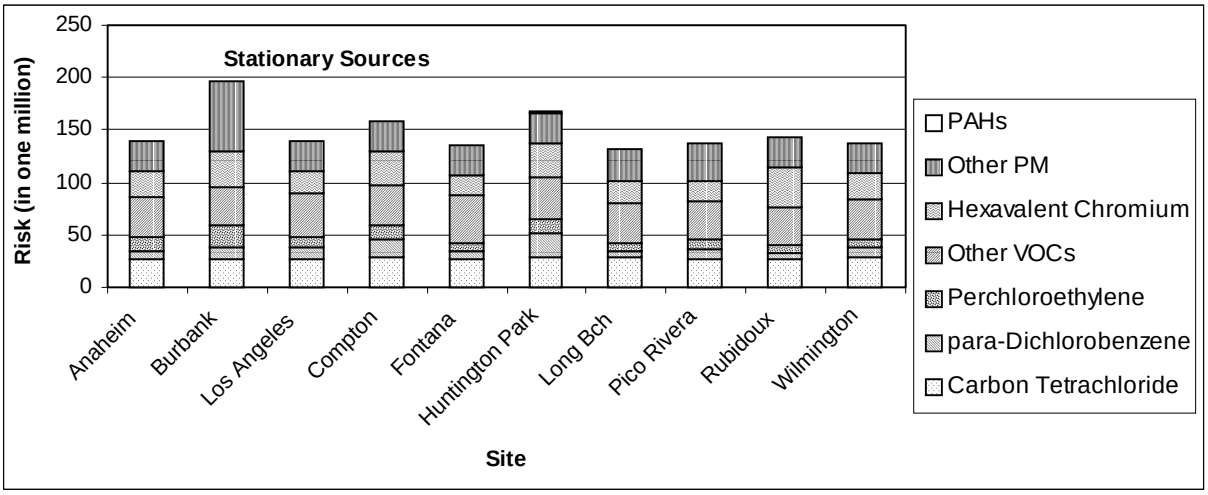


*Based on the average of the pollutant concentrations measured at the fixed monitoring sites.

Figure ES-3
Cancer Risks at the MATES-II Fixed Sites
Risks are shown for all sources including diesel particulates (top),
all sources excluding diesel particulates (middle), and stationary sources (bottom).







* No Elemental Carbon Measured

Figure ES-4

Monthly Variation in Cancer Risks for all Sources
Including Diesel Particulates (top) and for Stationary Sources (bottom)

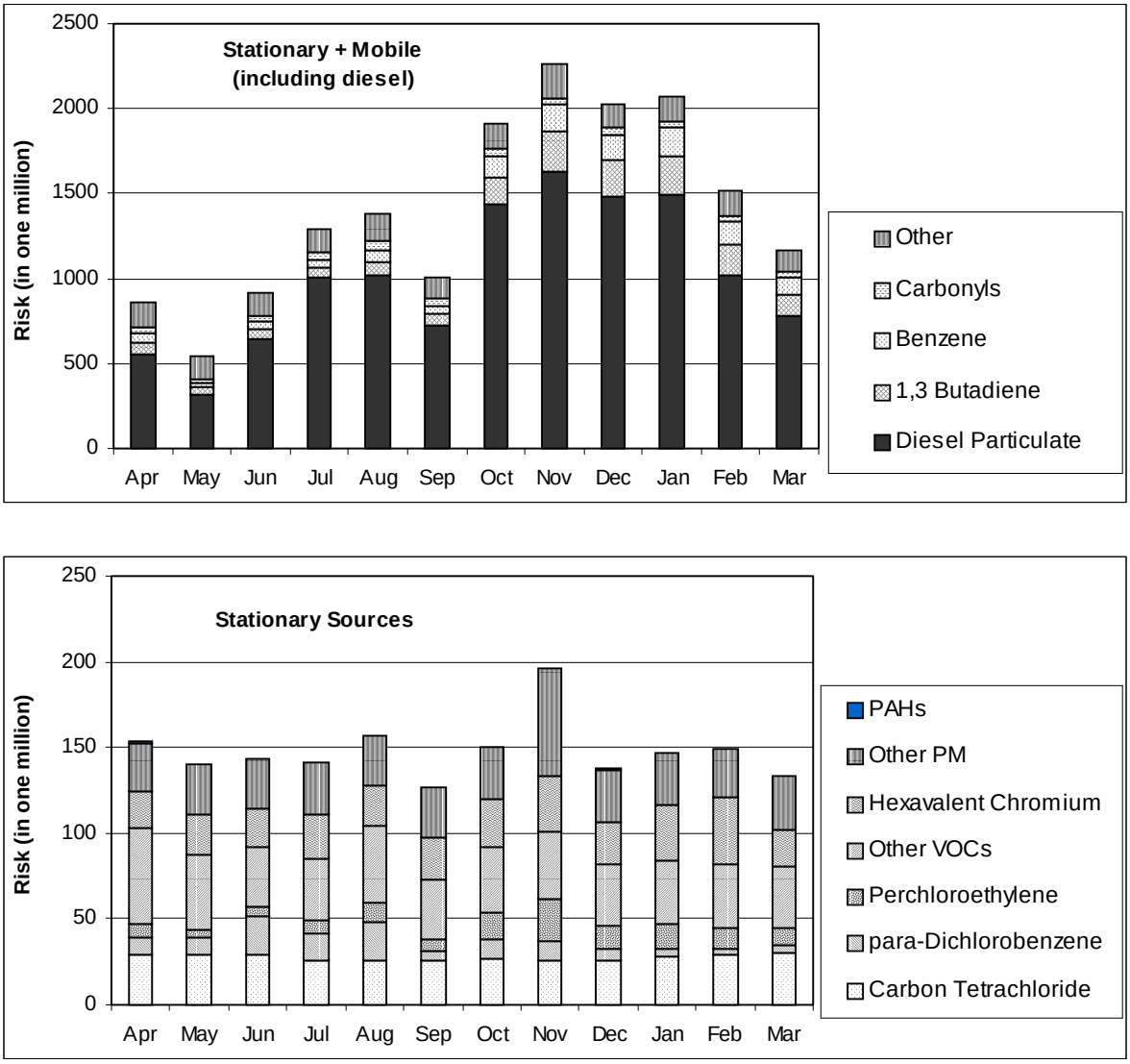


Figure ES-5

Model Estimated Risk for the Basin

(Numbers in a million, all sources.)